

REMARKS

Applicant has carefully reviewed and considered the Office Action mailed on July 16, 2003. Claims 39, 40, 45, 51, 65, 66 and 67 are amended. Claims 23-67 remain pending in this application. Applicant amended the claims to recite language that further clarifies that the recited subject matter compensates for the phase shift error in the phase shifting mask.

Information Disclosure Statement

Applicant respectfully requests that a copy of the 1449 Form, listing all references that were submitted with the Supplemental Information Disclosure Statement filed on December 12, 2001 (a copy of which was also faxed to the Examiner on April 24, 2002), marked as being considered and initialed by the Examiner, be returned with the next official communication.

Double Patenting Rejection

Claims 22, 32, 34, 36, and 39 were rejected under the judicially created doctrine of double patenting over claims 1, 3, 4, and 33 of U.S. Patent No. 6,096,457. Applicant will consider filing a Terminal Disclaimer when all claims are indicated to be otherwise allowable.

§103 Rejection of the Claims

Claims 23-29, 31-33, 36, 38-42, 45, 46, 51, 53-58, and 61-67 were rejected under 35 USC § 103(a) as being unpatentable over Gortych et al. (U.S. Patent No. 5,680,588) in view of Suzuki (U.S. Patent No. 5,673,102). Applicant respectfully traverses, for at least the following reasons.

The Office Action identifies element 18 of Suzuki as a restrictor to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter which improves imaging. It appears that element 18 of Suzuki has a number of configurations. Should the Examiner maintain the rejection, Applicant respectfully requests the Examiner to identify portions of the references which are relied upon to make the rejection. Applicant also respectfully traverses the characterization that the restrictor is a "design choice," and requests the

Examiner to clearly identify the reasons why it would be obvious to combine the Gortych et al. reference with the Suzuki reference.

Applicant is unable to find in the Suzuki reference a suggestion that the stop member 18 of the Suzuki reference is used with a phase shifting mask. Rather, it appears that the subject matter of the Suzuki reference is intended to distribute light similar to a phase shift mask and as an apparent alternative to the phase shift mask (col. 5 lines 8-10, col. 20 lines 43-49).

Additionally, Applicant is unable to find a suggestion in the Suzuki reference that a phase shifting error in a phase shift mask is compensated. Furthermore, Applicant is unable to find a suggestion in either the Gortych et al. reference or the Suzuki reference to use the stop member 18 with the system disclosed in the Gortych et al. reference.

With respect to independent claim 23, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a system that includes a combination of a phase shifting mask and a restrictor to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter where the restrictor is to adjust illumination parameters associated with the first perimeter and the second perimeter to compensate for a phase shift error in the phase shifting mask, as recited in the claim.

With respect to independent claim 27, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a system that includes a combination of a phase shifting mask and a restrictor to provide off-axis illumination, as recited in the claim. The recited restrictor is adapted to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter. The claim further recites that parameters associated with at least one of the first perimeter and the second perimeter are optimized to compensate for a phase shift error in the phase shifting mask.

With respect to independent claim 29, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a lithographic system that includes a restrictor and a phase shifting mask, as recited in the claim. The restrictor is adapted to provide off-axis illumination where the restrictor to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and

a second perimeter that surrounds the first perimeter. Parameters associated with at least one of the first perimeter and the second perimeter are optimized to compensate for a phase error in the phase shifting mask.

With respect to independent claim 32, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of system, comprising a phase shifting mask having a phase shift error, and an illuminator configured to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter, as recited in the claim. The claim further recites that a number of off-axis illumination parameters associated with at least one of the first perimeter and the second perimeter are optimized to compensate for the effects of the phase shift error, that the illuminator uses empirical data in optimizing the off-axis illumination parameters, and that the empirical data is taken from one or more simulations of an image on the attenuating phase shifting mask.

With respect to independent claim 36, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of an illuminator for a lithographic system, comprising a light source for providing light, and a restrictor for providing off-axis illumination, as recited in the claim. The restrictor is adapted to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter. The restrictor provides means for optimizing parameters associated with at least one of the first parameter and the second parameter to compensate for a phase error in a phase shifting mask.

With respect to independent claim 39, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of an illuminator, comprising a light source for providing light, and a restrictor to restrict light from passing through a first region having a first perimeter and to pass light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter, as recited in the claim. The restrictor provides means for optimizing printing of a phase shifting mask to compensate for a phase shift error in the phase shifting mask.

With respect to independent claim 40, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method that includes restricting light

from passing through a first region having a first perimeter and passing light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter, simulating an image on the phase shifting mask, and adjusting parameters associated with at least one of the first perimeter and the second perimeter to compensate for a phase shift error in the phase shifting mask.

With respect to independent claim 45, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method of optimizing printing of a phase shifting mask having a phase error that includes varying a depth of focus of the image on the phase shifting mask and including varying sigma in and sigma out parameters to compensate for the phase shift error of the phase shifting mask, and providing a means for controlling the light source to optimize printing of the phase shifting mask based upon the one or more simulations, as recited in the claim.

With respect to independent claim 51, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method of compensating for a phase error in a phase shifting mask, comprising restricting light from passing through a first region having a first perimeter and passing light through a second region between the first perimeter and a second perimeter that surrounds the first perimeter, simulating an image on the phase shifting mask, and adjusting parameters for the off-axis illumination based upon one or more image simulations to compensate for the phase error in the phase shifting mask, as recited in the claim.

With respect to independent claim 57, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a system that includes a combination of an illuminator, a restrictor adjustment on the illuminator to adjust off-axis illumination, and a phase shifting mask, as recited in the claim. The restrictor adjusts at least one parameter associated with at least one of a first perimeter and a second perimeter that surrounds the first perimeter. The restrictor adjustment varies light from the illuminator with respect to an optical axis, and restricts light from passing through a first region defined by the first perimeter and passes light through a second region between the first perimeter and the second perimeter. The restrictor adjustment on the illuminator compensates for a phase shift error in the phase shifting mask.

With respect to independent claim 40, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a system comprising an illuminator, a restrictor sigma in and a restrictor sigma out for varying light from the illuminator with respect to an optical axis, and a phase shifting mask, wherein the restrictor sigma in and the restrictor sigma out compensates for a phase shift error in the phase shifting mask, as recited in the claim.

With respect to independent claim 63, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a lithographic system, comprising an illuminator, a restrictor adapted to provide off-axis illumination, a phase shifting mask, and an optics lens, as recited in the claim. The restrictor includes a ring having an inner radius and an outer radius, where light is not passed within the inner radius. Parameters of the off-axis illumination are optimized to compensate for a phase error in the phase shifting mask.

With respect to independent claim 64, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of an illuminator for a lithographic system, comprising a light source for providing light, and a restrictor for providing off-axis illumination, the restrictor including a ring having an inner radius and an outer radius, as recited in the claim. Light is not passed within the inner radius. The restrictor provides means for optimizing parameters of the off-axis illumination to compensate for a phase error in a phase shifting mask.

With respect to independent claim 65, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method of compensating for a phase error in a phase shifting mask that includes providing a light source and a restrictor ring for controlling the light source, simulating an image on the phase shifting mask, and adjusting parameters for the off-axis illumination based upon one or more image simulations to compensate for the phase error in the phase shifting mask, as recited in the claim.

With respect to independent claim 66, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method of compensating for a phase error in a phase shifting mask that includes providing a light source and a restrictor sigma in and a restrictor sigma out for controlling the light source, simulating an image on the phase shifting mask, and adjusting parameters for the off-axis illumination based upon one or more image simulations to compensate for the phase error in the phase shifting mask, as recited in the claim.

With respect to independent claim 67, Applicant is unable to find, among other things, in the Gortych et al. and Suzuki references a suggestion of a method of compensating for a phase error in a phase shifting mask that includes providing off-axis illumination, simulating an image on the phase shifting mask including varying a depth of focus of the image on the phase shifting mask and varying sigma in and sigma out parameters, and adjusting parameters for the off-axis illumination based upon one or more image simulations to compensate for the phase error in the phase shifting mask, as recited in the claim.

Applicant believes that the above-identified independent claims, and those claims which depend on them, are patentable at least for the reasons provided above. Thus, Applicant respectfully requests reconsideration and allowance of claims 23-29, 31-33, 36, 38-42, 45, 46, 51, 53-58, and 61-67.

Allowable Subject Matter

Claims 30, 35, 37, and 52 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Applicant acknowledges with thanks the allowance of claims 43, 44, 47-50, 59, and 60.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 373-6960 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

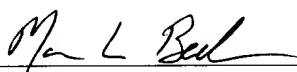
Respectfully submitted,

CHRISTOPHE PIERRAT ET AL.

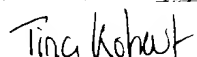
By their Representatives,

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Date 9-16-03

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Reg. No. 38,377

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop AF, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 16 day of September, 2003


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